

Hab. Z₀ P. occ. ad aggeres arenosos umbrosos circa *St. Sever*, copiose et pulcherrime!

43. *Distichium*, Bryol. Europ.

254. *D. capillaceum*, Hedw. Musc. Frond. 2. t. 26 (sub *Swartzia*); Br. Europ. *Distichium*, p. 4. t. 1; M. P. 199.

Hab. Z₁₋₄ in rupibus udis præsertim calcareis, frequens.

255. *D. inclinatum*, Hedw. Musc. Frond. 2. t. 27 (sub *Swartzia*); Br. Europ. *l. c.* p. 5. t. 2; M. P. 200.

Hab. Z₃₋₄ P. c. in rupibus micaceis juxta lacum alpinum dict. *Lac Lehou*; nec non in valle alpina *Esquierry*: rarissimum.

[To be continued.]

XL.—*Observations on the recent Foraminifera.*

By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Norfolk Crescent, Bath, Feb. 22, 1849.

I HAVE for many years employed myself in malacological pursuits, and had opportunities of observing some of the recent Foraminifera, particularly those of the coralline zones of the South Devon coasts.

As long ago as 1834-5, my friend Mr. Jeffreys of Swansea, who by his extensive researches throughout the British Isles for new and rare Testacea has rendered eminent services in promoting conchological and malacological science, was on a visit to me at Exmouth, during which we had frequent disquisitions on the nature of those minute organisms which at that time were termed Cephalopoda; I then strenuously advocated that they belonged to the coralline group, and were of course polypiferous, and that I believed them, in their natural habitats, to be fixed, similarly to the great mass of Zoophytes; these views, except on the point of fixity, have been fully corroborated by M. Ehrenberg's observations, and during the last summer, 1848, I was enabled, by the occurrence of very recent specimens of *Orthocera Legumen*, to ascertain some new facts relative to these foraminiferous polypes. It has been, I believe to this day, a matter of doubt, if they have at the anterior end tentacular filaments, and as proof in the affirmative, in *Orthocera Legumen*, I have specimens in which the dried linear cilia, about eight, are distinctly to be seen lying radiated in the external sulci of the striulæ of the aperture, and I have little doubt that the creature can withdraw them within the internal hollows of the striæ.

As to the other organs of *O. Legumen*, I could only observe in the two or three anterior cells, a dried, perhaps in life, a pulpy mass, apparently inclosed in a membranous sac of a brown colour, but in the posterior chambers there were scarcely any traces of this substance, as these appeared to be nearly transparent; it may also be presumed that the membranous sac contains the viscera.

The constructor of the calcareous cells of *O. Legumen*, which communicate with each other by constricted orifices, seems not to be an animal with lobes, deposited in the chambers, or an aggregation of polypes linked together, with a common canal for reproduction, sustentation and depuration, but a solitary being produced from a gemma, cast by the parent on a marine substance, which, springing therefrom, constructs the first cell, in which it lives and dies, having previously by gemmation produced its successor, the architect of the second cell, and so on, until nature has completed the appointed number.

These inferences arise from the brown membrane, or mantle, or pulp, not being visible in any other than the two or three anterior chambers; the matters which were originally in the posterior, or first cells, probably more hyaline, appear to be lost by collapse and desiccation of the animal.

I have also removed by acids the calcareous cases of many others of the Foraminifers, and they have nearly presented the same appearances that have just been stated; from this it would appear that the live polype is only to be found in the last cell, those of the preceding ones having each perished as soon as it had produced the germ of its successor.

The branchial organs are probably those minute delicate filamentary points observed by M. Ehrenberg and others, and are perhaps capillary prolongations of the membranous sac or mantle, and serve for the aëration of the circulating fluid as well as for effecting the formation of the calcareous case: that these communications with the animal through the foramina have not been discovered in the membrane investing it cannot be a matter of surprise, when its minuteness and tenuity are considered, and the examinations being made, if not in a completely dried state, at least in conditions of great collapse.

These filaments have been considered as spurii pedes, and subservient to locomotion; this idea I shall prove by and by to be erroneous, by showing that the *Orthocera*, and beyond doubt, some of the *Lagenæ*, are fixed to marine substances by a posterior mucronal style; and I believe that the rest of the Foraminifera, when in their natural habitats, are fixtures.

The contents of cabinets are composed of detached substances found in coral sand, with their characters usually lost by continual

attrition, and very often are imperfect fragments, which have passed for perfect organisms, as I shall presently demonstrate.

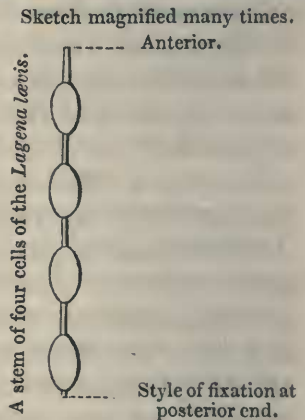
The *Orthocera* are fixed by the subulate style at the posterior end, though most cabinet specimens are broken off and rounded by the corally particles and agitation of the waters.

Many of the *Polystomellæ* and other discoid forms have, when perfect, a spiny periphery, by which they are permanently fixed to marine objects, and in this state I have often seen the *Polystomella crista*, but when detached the spines fall off, or are worn away. The *Rotalia Beccarii* adheres by its concave surface. The *Lobatula vulgaris*, every one knows, is attached to stones, shells and zoophytes; and why should not the rest of the Foraminifers be in a similar category?

But the decisive proof that most of these calcareous structures are naturally fixtures, will be manifest from the sketch of the configuration of the *Lagena levis*. This organism, in a state of nature, is never in distinct flask or urn-shaped portions, unless the incipient or primary cell is met with: the real structure is, that these flask-shaped forms are the cells of a Foraminifer superincumbent on each other, and permanently united: to what number they amount to, when in a perfect state, I cannot say, but I *have seen*

a stem of at least four united cells, the posterior one being furnished with the style of attachment. All naturalists have hitherto figured this foraminiferous form in broken fragments, which they have considered to be perfect, distinct and separate forms, likening them to an oil-flask or urn, with the neck margined at what they thought was the terminal orifice, whereas these flask-shaped cells are only portions of a stem of chambers, which from the extreme delicacy of structure are broken by the slightest touch, at the neck, usually bringing away with it a small circular portion of the bulb of the preceding cell, giving the neck the appearance of a margin which is smoothed by attrition. As to the polype of the *Lagenæ*, I can say nothing more than what I have stated with respect to *O. Legumen*. Finally, I may observe, that there is little doubt that all the species of these minute organisms are foraminiferous, and inhabited by polypiferous creatures.

It may perhaps be thought, that in my observations on the polype of the Foraminifers I have stated hypotheses instead of facts; but it must be recollected that in the obscure and difficult points of natural history, this mode of searching out truth must be submitted to as the best the case admits of, and it is often a



very efficient aid by exciting discussion. On these natural phenomena we cannot at once apply mathematical demonstration, but must be content to obtain facts, and arrive at truth by inductions, in the first instance, from hypothesis.

I am, Gentlemen, your most obedient servant,
WILLIAM CLARK.

P.S.—Since the above observations were written I have examined a great number of the *Lagena striata*, and have no doubt that, like the *Lagena lævis*, they form in their natural habitat, a fixed stem of cells piled on each other.

XLI.—On the *Animal of Kellia rubra*.

By JOSHUA ALDER, Esq.

To Richard Taylor, Esq.

DEAR SIR,

Newcastle-on-Tyne, April 18, 1849.

CAN you spare me room in the next Number of the 'Annals' for a few remarks on Mr. Clark's interesting letter on *Kellia rubra*?

I am glad to find that Mr. Clark is enabled to confirm my statement that the anterior tube of this species is an open fold of the mantle: the only difference now between us is as to its uses, involving the question of the mode of supplying a current of water for respiratory and alimentary purposes.

In cases where a matter of fact is in dispute, it is always best, before arguing the point, to test the truth of former observations. On reading Mr. Clark's letter, therefore, I resolved, as he had done, to submit this little bivalve to a re-examination; and accordingly applied to my friend Mr. Cocks of Falmouth to send me a few specimens by post, as it is rather difficult to procure on our part of the coast. Mr. Cocks very obligingly and promptly complied with my request by sending me above a hundred specimens, which, after a land journey of nearly 500 miles, arrived quite fresh, and immediately showed signs of life on being put into sea-water. I placed two or three of these in a watch-glass under the microscope, and examined them by transmitted light, the mode I had before employed with success to observe the currents in this species as well as in *K. suborbicularis*. By this means I distinctly saw, as on former occasions, a continuous current of water flowing into the anterior tube; indicated by the minute floating particles it contained, which were gradually drawn towards the tube, and one after another passed into it in quick succession. In this manner I examined many individuals, and always with the same results. When the water is perfectly clear